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Water usage in the Shasta Valley

Before about 1850, residents of the Shasta Valley were content with the rivers and streams however nature chose to present them from year to year. With the discovery of gold, and the subsequent immigration of new residents, all that began to change.

The first changes were in the form of the diversion of streams for use in washing gold from the soil around Yreka. Because of the climate, the available water supply rapidly proved to be inadequate to meet local demand, and soon a ditch (the Yreka Ditch) was planned and constructed from the headwaters of the Shasta over a distance of 90 miles all the way to Yreka. Substantial additional efforts were expended in attempting to de-water the Yreka Creek alluvial plain from Yreka downstream to allow mining access down to bedrock, often 40 feet below the surface. A ditch (the Antonio Ditch) was dug from near the present HY 3 crossing of the Shasta River, all the way to near Hawkinsville. Smaller ditches can be found through the Shasta Canyon, where they were used to wash soil from bedrock to access gold deposited there.

None of those mining ditches served their design function for very long. The gold played out, and people found that more reliable income could be generated by ranching and farming. Many of the mining ditches were converted to irrigation ditches, and dozens of new ditches were dug, allowing crops and livestock to be successfully raised throughout the Shasta Valley. This process of development continued steadily until about 1930, when apparently much of what could be done by way of water development had been done. 1930 did not end efforts at expanding irrigated agriculture, but changes since then have been on a much smaller scale.

Irrigation methods in the Shasta Valley

Early white immigrants found the Shasta Valley to be essentially a vast, dry, treeless plain. From their perspective, most of it was usable only in the spring, when soil moisture supported the growth of grass that could be used to feed horses, cattle and sheep. Once summer arrived, the carrying capacity of the land fell off rapidly, and livestock either moved to the very limited riparian areas, or had to be moved to the mountains where spring arrived later, summers were cooler, and precipitation and soil moisture could provide feed through the summer. Successful ranching required either a balance of low lying ground in the Shasta Valley for winter and spring use, and mountain pastures for summer and fall use, or else a mixture of irrigated and unirrigated ground that could provide a combination of pasture and stored hay for the entire year. Since available mountain pastures were extremely limited, the need to develop irrigation systems became intense.

How people irrigate is determined by several factors, including whether or not water is available from a sufficiently higher elevation to allow it to distribute itself by gravity (allowing flood and furrow irrigation), soil porosity, which may dictate the use of sprinklers, availability of electricity or other source of power, and the nature of the crop grown.

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Early irrigation systems were constrained by lack of available power, so were entirely dependent on gravity for the movement of water[1]. The oldest ditches and the oldest water rights all are for flood irrigation, where water is forced out of the stream channel, generally by constructing a seasonal dam in the river or stream to raise the level of the water, then allowing some or all of the stream to run down a ditch that runs downhill with as little a slope as possible[2]. Gradually the ditch is directed away from the river in order to minimize its slope. Given sufficient length, there eventually can be a large area that is downhill from the ditch, where water can be let out of the ditch and run across the ground to keep crops green through the summer. Ditches constructed for this purpose start with a single large ditch, which eventually forks into increasingly smaller ditches to allow the water to be spread as uniformly as possibly over as much ground as possible.

Not all flood irrigation systems are entirely driven by the force of gravity. More recent systems often utilize a pump to lift the water out of the river, and discharge it into a ditch at a much higher elevation than the source of the water. The water is then distributed via conventional flood irrigation techniques.

Flood irrigation completely saturates the upper layers of soil with water, displacing oxygen in the soil. If done continuously, only plants tolerant of anaerobic conditions—sedges, rushes and similar wetland plants could survive[3], so irrigation is done intermittently, generally every two to four weeks. Ideally, sufficient water[4] is applied to wet (not saturate) the upper two feet or so of soil. That water is then available either for use by plants, or it can be lost to evaporation. If too great an amount of water is applied, it is likely to either run off the surface and be lost (known as irrigation tailwater)[5], or soak in deeper than the effective root depth of the plants. In either case, nutrients that could have been available to the growing plants tend to be washed away, along with soil in the case of surface runoff.

The biggest advantage of a gravity powered irrigation system is that once the infrastructure—dam and ditches—are in place, the out of pocket costs of operation are the lowest of any managed irrigation system. The disadvantages include diminished productivity during those periods of each irrigation cycle when soil oxygen is displaced, difficulties in effectively and uniformly distributing the water, and the necessity for ditch and dam maintenance. (Ditch maintenance especially can become extremely burdensome if the ditch is long). This form of irrigation is little changed from the practices utilized by the ancient Egyptians, Romans, Mayans, etc.

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[1] A few old systems did exist that utilized dip wheels to lift the water to a sufficient elevation to allow it to be used on fields near the river, but their capacity was small, and all have been replaced with other methods or long since abandoned.

[2] Generally 1-2 inches per 100 feet.

[3] These plants generally are slow growing and of such low nutritional value that substantial effort is made to minimize their presence.

[4] The quantity varies considerably, but 4
inches is probably a good average amount applied per irrigation cycle.

[5] Unfortunately, the creation of tailwater is inherent in the use of flood irrigation. Roughly 25% more water than the plants need must be applied to provide the "push" required to move water across the field in a timely fashion. That water can be either captured for further irrigation use, or allowed to return to the stream.

More recently, the effects of irrigation runoff on water quality—by bringing nutrients, sediment and heat back to the river—have been added to the list of disadvantages inherent to flood irrigation. The magnitude of those "costs" has not yet been fully defined[6], nor is minimizing those costs yet fully integrated into many water managers irrigation planning. Once those costs are fully defined, flood irrigation may no longer be the cheapest form of irrigation.

The other commonly used form of irrigation in the Shasta Valley is sprinkler irrigation. Sprinkler systems generally consist of a buried mainline to distribute the water, and a movable sprinkler or series of sprinklers aboveground[7].

The mainline may run along the edge or center of the field, with periodic openings that can be connected to the surface sprinklers and turned on or off, or may run to the middle of the field, and connect to a center pivot system (see below).

The simplest system consists of a pump to pressurize the water, and a very large sprinkler called a "big gun", which is essentially a giant Rainbird type sprinkler. It can be towed from place to place, and connected to a main distribution line, and then sprinkles a large circle. The disadvantage is the necessity of frequent moves to irrigate a large area, and the fact that the area it irrigates is round, while most fields are rectangular. The advantage is relatively low initial cost, and system simplicity. Properly managed, a big gun system should not produce significant tailwater.

The most basic system of movable pipe with multiple sprinklers include "hand line" (a series of individual irrigation pipes generally 30 feet long with Rainbird type sprinklers installed intermittently) that slide together during use, and which can be easily separated into individual pipes for moving. Hand line must be picked up, moved and plugged together in steps the full length of a field, and is connected to a valved outlet in the mainline at each step. The hand line is left with the sprinklers running at each step long enough to apply sufficient water to meet the plants' needs, along with anticipated evaporation losses. Once the full length of the field has been irrigated, all the individual hand line joints of pipe with attached sprinklers must be picked up and moved back to the start and the whole process repeated. This must go on throughout the summer.

Hand line has a low initial cost, and will irrigate rectangular areas effectively, but the obviously high labor costs make it uneconomical except for relatively short-term use or for very small fields.

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[6] The workings of the federal Clean Water Act, with its required allocation of total maximum daily loading (TMDLs) and the federal Endangered Species Act, with the necessity not to impair further the habitat of listed cold water fish, will force the cost of irrigation runoff to be defined in the near future.

[7] Completely buried systems, with distribution lines feeding sprinklers that are permanently installed as is common in residential lawns, golf courses and similar situations are generally found to be cost prohibitive for most agricultural uses in the Shasta Valley.

The next step up from a hand line is a "wheel line". With a wheel line, up to several hundred feet of pipe made up of individual sections with sprinklers attached stays in one piece, and is rolled across the field on wheels that are integral to the joints of pipe. Like hand line, a wheel line is moved across a field in a series of steps, and is connected to a buried mainline at each step, then left with the sprinklers running until it is time to be moved again. At the center of each wheel line is a gasoline motor that provides the power needed to roll the whole assemblage across the field.

Wheel lines have higher initial costs, but one person can manage a fairly large system alone.

Center pivots are the last form of sprinkler irrigation with multiple sprinkler heads. Center pivot systems consist of a long arm (up to ½ mile long) made up of individual sections on wheels. One end of that arm connects to the water supply pipe in the ground with a rotating joint. The wheels in each section are powered, and their speeds are individually set to allow the entire arm to move in an arc[8]. Likewise, each individual sprinklers must release an increasing amount of water as they get further from the center of the circle in order to apply an equal amount to each square foot of ground.

Center pivot systems are generally sized to run continuously through the entire irrigation season. By the time one entire rotation is completed, it is time to start over. They can also be designed to sweep through less than a full circle.

The main disadvantage to all sprinkler systems is the requirement that the water be pressurized in order to allow the use of sprinklers. Electrical costs can become substantial, particularly if the source of water is from wells which incur additional electrical costs to lift the water from below ground level. A second disadvantage is that in dry and windy areas, significant amounts of water can be lost to evaporation before it even reaches the ground. Maintenance can also become an important consideration, particularly with center pivot systems, where complex computer control systems and variable drive systems are essential, and potentially beyond the maintenance capabilities of many operators.

The benefits of sprinklers include the ability to irrigate ground too irregular to irrigate using flood irrigation, increased productivity because the soil oxygen is not displaced, and in most cases, less water is required both because it can be applied more uniformly, and because electricity, gasoline or the irrigator (rather than a 25% excess application as with flood irrigation) provides the "push" to distribute it. A well-managed sprinkler system also does not create tailwater.

The last form of irrigation found in the Shasta Valley is drip systems. Drip can be used only on plants that are growing in rows or that can otherwise be watered on an individual basis. It cannot be used to irrigate pastures, where the plants needing water form a continuous cover on the ground. While drip irrigation is used here on some small commercial orchards, it is unsuited to most of the crops that can be economically grown in the Shasta Valley.

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[8] Because the circumference of the circle each wheel must travel increases with distance from the center, the wheels that are located furthest from the center must be turning much faster than those near the center of the circle in order for the entire assemblage to complete an entire circuit in the same amount of time.

Value of water for irrigation

Irrigation water meets a variety of needs, ranging from aesthetic (keeping the property green) to cultural (economically a given landowner may not have to raise livestock, but he or she wants to and it does supplement their income) to economically essential (full time ranchers who must grow enough grass during the summer to feed their livestock through the entire year). What water is worth in each of these instances is difficult to state with certainty, since the decisions and valuations are made on an individual basis. The most reliable index of the value of water is probably to look at what it sells for (delivery costs) within the irrigation districts, and try to see at what point in the pricing structure demands change. This approach is complicated by the various methods used by each of the districts to bill for water. They include:

Grenada Irrigation District has a two tiered payment system—"stand-by" for persons who do not want to pay for water, and "regular", for those persons who want irrigation water for the entire summer. Payment is not optional—this is a property tax based district, and failure to pay the assessment eventually would result in forfeiture of the land. The charge assessed for "stand-by" as nearly as possible reflects the fixed overhead cost of maintaining the infrastructure—employees, pumps, ditches, buildings, equipment, etc. The "regular" fees also include the cost of the electricity required to lift the water from the river, and discharge it into the distribution ditches. These fees are adjusted each year, depending on anticipated costs, and whether or not costs stayed within budget the preceding year.

Irrigation rotation periods vary each year, from perhaps 12 to 20 days, depending on how many landowners decide to irrigate in a given year. Irrigation cycles approaching 20 days are considered to be too long for maximum production.

In any year, each landowner has to weigh the "cost with no benefit" afforded by opting for standby, against the value or cost of water for irrigation. Irrigation potentially entails additional costs in terms of labor for the maintenance of individual ditches, and the distribution of water into the fields from those ditches. Water can be and is delivered at any time of the day or night, making management difficult for persons working jobs in town. The cost of the water and labor is offset either by the value of the forage produced and used by the landowner's livestock, or in the form of pasture rental to someone better able to utilize the land and water than the owner is. Pasture rental does not always equal or exceed the out-of-pocket costs of the "regular" charge for receiving water, leading some people to choose "stand-by" and others to irrigate at a loss. Stand-by costs tend to be around $45/acre, while costs to irrigate total over $105/acre each year. Increasing power costs will push this cost up.

The Grenada District is relatively far from the Shasta River, and the soils are sandy, with the result that little if any water returns to the Shasta as surface tailwater. The Grenada Irrigation district provides water for the irrigation of about 1300 acres.

Shasta Water Association is a farmer owner cooperative, with each landowner holding shares entitling them to part of the available water, but also obligating each of them to a proportionate share of the costs, whether or not they take water. Water is then distributed on a per share basis, every 12-18 days. Costs per share are set every year at a level that will equal the anticipated operating costs for that year, plus any deficiency that might have been carried over from the previous year.

As with other irrigation districts in the Shasta Valley, the water in the Shasta Water Assoc. can be delivered at any time of day or night, and cannot be deferred until later, again making effective utilization difficult for persons working in town. Sub-division of lands within the district has compounded utilization difficulties by splitting parcels from distribution ditches, and requiring that water to some be delivered by flowing overland across fields that were once continuous, a situation that requires ongoing good relationships between neighbors.

Soils within the Shasta Water Association are often both shallow and sloping, limiting opportunities for land leveling or other management measures that would improve the efficiency of water utilization, and resulting in a tendency in parts of the district for the increased creation of tailwater. Persons outside the district, but downhill of it, often come to rely on this water to meet their irrigation needs, but not all water leaving the district can be captured for re-use at the present time. Costs within the district tend to hover around $50-60/acre/year, but again will rise with increasing power costs. The SWA provides irrigation water to roughly 4,200 acres

Montague Irrigation District (MID) operates the closest to a free market system. Landowners within the district are each entitled to a share of the available water (based on irrigable acres) at a baseline cost, and can buy supplemental water at a higher cost (if it is available). Depending on the quantity of water stored in Lake Shastina, the MID directors set the base and supplemental water costs high enough to cover their anticipated costs for the year. Stand-by charge for no water is roughly $1.50/acre /year.

Some years this cost is low enough that the landowners within the district are reasonably well compensated for the costs and labor involved in farming and ranching, and some years the costs of water are too high, resulting in substantially reduced ranch income. High costs result from drought years, when the fixed costs of operating and maintaining the irrigation district must be covered by the relatively small amount of water sold.

Landowners can be faced with the difficult choice of not irrigating at all in years where the prices are too high, but then having to buy feed, liquidate their herds or have essentially no farm income, or cause a permanent pasture to die due to lack of water and have to be reseeded the next year. Pastures which need to be reseeded generally cannot be grazed or harvested for at least two years. Given these choices, most landowners are forced to purchase water even when the cost is ruinously high, in order to maintain the future productivity of their fields. Four to five years of high water costs results in a large increase of forced sales and foreclosures of farms.

Pricing: Lowest costs in the last 10 years: $12/acre-foot
Highest cost of water in last 10 years: $20/acre-foot
The MID provides irrigation water to roughly 5,900 acres.

While water costs of $20/af are apparently ruinously high in the long run, when water is priced at that level water users find it practical to manage their water much more carefully than they do at $12/af., indicating that there may be water management measures that are not viewed as cost effective at $12, but that are worthwhile at $20. Conversely, managers may be underwatering their crops, and forgoing maximum production in favor of reduced water costs. Probably a combination of both is occurring. The creation of irrigation tailwater varies somewhat with the price of water also.

The MID also supplies domestic drinking water to the city of Montague.

Water requirements of plants

Regardless of the method used, plants have definable needs for water needed to achieve maximum growth. Those plant needs, added to any water losses that occur before or after the water reaches the plant, equal the application needs of the landowner. Different crops have different water needs, just as they have different soil and temperature needs. The climate of the Shasta Valley is the primary determinant of what crops are possible. The relatively short growing season, coupled with very low winter temperatures and long distances to markets or processors means that most of the row cropped vegetables grown in the Central Valley are either not possible or not economically competitive. Exceptions include garlic, potatoes, and strawberries for rootstock. One recent arrival to the area is trying to grow lavender. The fact that very few people attempt any of these crops indicates either an economic problem with them, or a marketing bottleneck.

What is left are the crops that can be reliably grown and either marketed or used by the grower for a known cost—grass and alfalfa hay, grass pasture, and grain, mostly wheat or barley. Estimates of plant water needs[9] for this general area are:

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[9] Water needs include transpiration, and evaporation form the soil. It does not include losses in conveying the water to the point of use, nor does it include losses to deep percolation.

Crop	**Average H2O Req.[10]**
Alfalfa	33.8"
Barley, small grains	21.6"
Pasture	30"

Observed Consumptive use[11]
23-33"
8.6-19"
26.7-31.9"

Individual landowners methods of water application, soil uniformity, slope, depth and texture, presence of a high water table and consequent sub-irrigation, and willingness to accept less than maximum yields all affect the actual amount of water used.

Differences between the estimates of water required[12], and the observed application rates could indicate approximate maximum water savings possible with improved efficiency measures without removing ground from production. It should be noted that excessive irrigation water in many cases eventually does return to the river, greatly complicating estimates of possible increases in instream flows that might result from improvements in efficiency of use. No data is currently available on actual application rates, either within irrigation districts, or on individual properties.

Water Laws and the Shasta Valley

California water law naturally applies to water usage in the Shasta Valley. Unfortunately, water law is something that has evolved as much as a result of court cases and common law as by legislative measures, and as such should probably be described as something of a confusing mess. Never the less, the fundamentals are clear, and the few details unique to the Shasta Valley can be readily understood once put into their historical context. See also attached document *Information Pertaining to Water Rights in California, 1990.*

At the time of statehood, responsibility for determining the best uses of water passed from the federal government to the state of California. California now has a public trust responsibility to allocate water to current "beneficial uses", or hold it in reserve for future needs. In the past, nearly all beneficial uses required removing the water from a stream[13], and spreading it on the ground for mining or agricultural use, or transporting it from the stream for domestic or industrial use. More recently, the scope of what was defined as beneficial use has been broadened to recognize what can most simply be described as instream flows intended to protect natural systems. The State Water Resources Control Board must pick among these competing categories whenever a request is made for use of water. (In fact, recently the courts have found that the state also may have to periodically review existing water rights to be sure they are still in the public's interest.)

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[10] Yreka U.C. Extension Ofc, unpublished figures based on long term weather data.

[11] *Klamath River Basin Investigation*, Bulletin 83, Calif. Department of Water Resources, July 1964, page 142. Combined evaporation and transpiration from field measurements made in 1953 and 1954.

[12] The Shasta CRMP Coordinator has worked with DWR to site an installation to provide current documented estimates of plant water needs in the Shasta Valley. Installation is expected to occur in 2002 and continue for 10 years.

[13] The most notable exception would be hydropower.

Anyone wishing to make personal use of the water found in streams and rivers in California must make a formal claim on that water. The basis of that claim can either be a "riparian right", if the parcel of land on which they wish to use the water borders the stream to some extent[14], or an "appropriative right" if the water is to be used on land that does not border the stream.

Riparian rights are based on ancient common law, handed down to us from the Romans via the English. Basically, any parcel that touches any part of a river or stream is "riparian" to that stream. As such, the owner of that land is entitled to some fair share of the water in that stream for his or her own personal use. Exactly how much is dependent on what beneficial uses the owner can put the water to, and what competing beneficial uses all the other riparian landowners may have in mind. If all the riparian landowners collectively want to use more water than there is in the stream, they must either find some way to share, or eventually turn to the courts to decide who is entitled to how much. The courts would then adjudicate the various water use claims and define how the water will be apportioned in the future.

Appropriative rights were devised as a way to allow the orderly distribution of water to lands that were not "riparian". The idea was that many rivers and streams had more water than the riparian landowners could use, and that the rest was going to waste. Appropriative rights were created as water rights that were secondary to riparian rights (i.e. any request for water from a riparian landowner had to be filled before water could be given to an appropriative user). An appropriative right to the use of water is only granted after all the necessary infrastructure to put it to beneficial use is in place and demonstrated as working—ditches, pumps, distribution systems, etc. all must be functional. Up to that point there is no private water right, only an application, with a date on it which will give it priority over any other applications filed after it. Once the water can be demonstrated as having been successfully put to beneficial use, a permit is issued, granting to the applicant the right to continue to use that water as long as he or she wants. Those permits are like any other personal property, and can be bought, sold or traded, as long as they continue to be exercised by continuing to use the water where originally described. If they cease to be exercised, the water can be given to someone else.

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[14] Here riparian is a legal term. Riparian land is the individual parcel of land that touches the stream. It can be as large as the original parcel first homesteaded, patented, etc. which touched the stream, or it can become progressively smaller through sub-division. It can never become larger, even if parcels are later combined. Whether or not a given parcel is riparian can only be determined with certainty through a title search.

Superficially, this all seems neat and orderly. In reality, these two systems of overlapping appropriative and riparian rights created difficult problems in terms of the orderly distribution of water. The state legislature recognized those problems and tried to resolve them in the last major revision of state water law in 1913-14.

Key Features of Water Law of 1914

Californians felt they had two major water related problems by the beginning of the 20th century—vast quantities of water were being "wasted to the ocean", and huge areas of land within the state were unusable because there was insufficient rainfall to allow the growing of crops. The solution seemed obvious enough—form associations of landowners to share the costs of applying for appropriative water rights, digging ditches and managing the water, and irrigate the dry lands with the surplus water from the streams.

It didn't take long for problems to develop—vast sums of money could be spent on developing all the necessary infrastructure to take water far from the streams, and permits for appropriative rights could even be issued, only to have some downstream riparian landowner decide he needed the water instead, and invariably the courts would affirm that riparian rights were superior to appropriative rights and the entire investment spent developing the appropriative water was lost. The consequence was predictable--good land continued to lay fallow, vast quantities of water continued to go to the sea, and the cities bulged with increasing numbers of underemployed people, threatening social unrest.

In addition, the riparian water rights system itself was also broken. How could landowners stretched over hundreds of miles of a single river be expected to coordinate their individual needs for water in order to divide it up in some fair fashion? Even if they could, how could anyone afford the time to make sure that agreements were adhered to?

The legislature concluded that the common law approach of riparian rights in many cases simply wasn't working, and often served as a roadblock that prevented the implementation of appropriative uses of water too. So in 1914, they decreed that all riparian rights not exercised within 10 years would be lost, and all future water rights from that point on would have to be secured by appropriation. They gave landowners 10 years to implement any plans they might have for their riparian rights, but after that it would be a matter of "first in time, first in right" in applying for the use of the peoples water, with no more undefined and unpredictable riparian rights blocking the orderly development of the huge areas of irrigable land in California.

The water law of 1914 also included provisions that allowed water users to ask the courts to sort out conflicting claims for water (adjudication processes), and created the Department of Water Resources (DWR), with the authority to provide watermasters[15] with the legal authority to assure adherence to the courts' findings.

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[15] Watermasters act as agents of the court, and are empowered to enforce the terms of the adjudication, and also help people to understand and comply with all water law. The costs of watermaster service are paid by

The Shasta Valley—

Throughout the state, as 1924 neared, irrigation districts had formed to take advantage of unused water, confident that few if any major changes could occur before the 1924 end of riparian rights. And by 1924, many watersheds, including the Shasta Valley, had requested that adjudication of the water rights be done. People were tired of sleeping on their diversion dams all summer to protect them, or finding them blown up, or having to drive from one end of the valley to the other trying to force appropriative users to cease using water that legally belonged to riparian users. By 1932, all the necessary information about uses of water in the Shasta Valley had been gathered. State Water Law of 1914 assured that no future riparian water rights could be initiated, and the Siskiyou County Superior Court confidently issued a decree listing how water was to be divided amongst all the existing water users in the Shasta Valley.

No one in the Shasta Valley seemed to recognize it at the time, but three years later, in 1935, the Shasta Valley Adjudication (along with several others) was dealt a severe blow. That year, the state Supreme Court, in the *Long Valley Decision*, concluded that the legislature had acted unconstitutionally in extinguishing riparian rights, and they were therefore re-instated. The Shasta Valley, along with numerous other watersheds that had adjudicated their water rights early on, was left with a court order that appeared to limit the exercise of future water rights except through the "first in time first in right" appropriation process, but which in fact could not prevent landowners of riparian land from initiating whatever future water uses they wished for their riparian lands.

Over time, most of the other watersheds in the state in a similar legal situation had enough problems that they were forced to re-do their adjudications, and through the court process were legally able to reduce riparian rights to a secondary standing, effectively eliminating them. Only the Shasta and the Carson Rivers are now left with this uncertainty. The potential costs and risks of changes to the adjudication, coupled with the fact that despite the adjudication's flaws water distribution continues to be an orderly process, has so far been sufficient to convince everyone to leave the topic alone. The primary credit for this should go to the DWR watermasters, who over the years have managed to keep the peace by one means or another. The bulk of water usage is still technically locked into the seasons of use, places of use, and quantities that were defined in 1932.

Flow gaging in the Shasta Valley

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the water users through a special property tax. Watermaster service is not mandatory, but has to be requested by some of the landowners that are subject to the adjudication.

US Geological Survey began gaging flows in the Shasta Valley in 1911. Locations have included the Shasta River near its mouth (1934-present) Shasta river near Montague ((1911-1933), Shasta near Edgewood (1962-1967) and the Little Shasta near Ball Mt. Road (1957-1978). DWR has been gaging flows at a variety of locations since 1921. See attached map.

In the course of adjudicating the water usage in the river, DWR gaged every flowing diversion, and installed gaging stations from roughly May through December of 1922, and April through December of 1923 for the Shasta River (6 stations), Parks Creek (2), Boles Creek (2), Little Shasta River (2), and Big Springs Creek (1). Combined discharges of the springs feeding Beaughan, Jackson, and Carrick Creeks were used to estimate the normal flow of each of those streams. Intermittent field measurements were made in Yreka and Willow Creeks. All of their findings can be found in the *Shasta River Adjudication Proceedings, Report on Water Supply and Use of Water from Shasta River and Tributaries, Siskiyou County, California*, July 1, 1925.

Since 1934, DWR has operated the gaging station near Montague originally established by the USGS, and since 1978 has operated the gage near Edgewood. DWR continues to maintain flumes at many diversions, but flow volumes are not recorded. Since 1934, some flow measurements were made at various springs and creeks, but this was done at the discretion of the individual watermaster, rather than on a regular basis. All flow data available can be found in the annual watermasters reports.

Apparently diversions from the Shasta were measured by the US Dept. of Agriculture in 1912, but the source of that data was unavailable (USDA Office of Experiment Stations Bulletin 254).

Conclusions

Water development and use in the Shasta Valley began in the 1850's, and has changed relatively little since the 1930's. Several large irrigation districts provide water for numerous family farms and ranches at varying prices. Rising electrical costs may push the cost of water to those users who rely on pumps to uneconomic levels, although costs will rise statewide and values for crops can be expected to adjust.

The adjudication of water rights in the Shasta Valley has managed to keep distribution of water for agricultural uses relatively orderly, but the exemption of riparian water rights from watermaster control leaves many questions unanswered, as do the unknown cumulative impacts of increasing ground water usage.

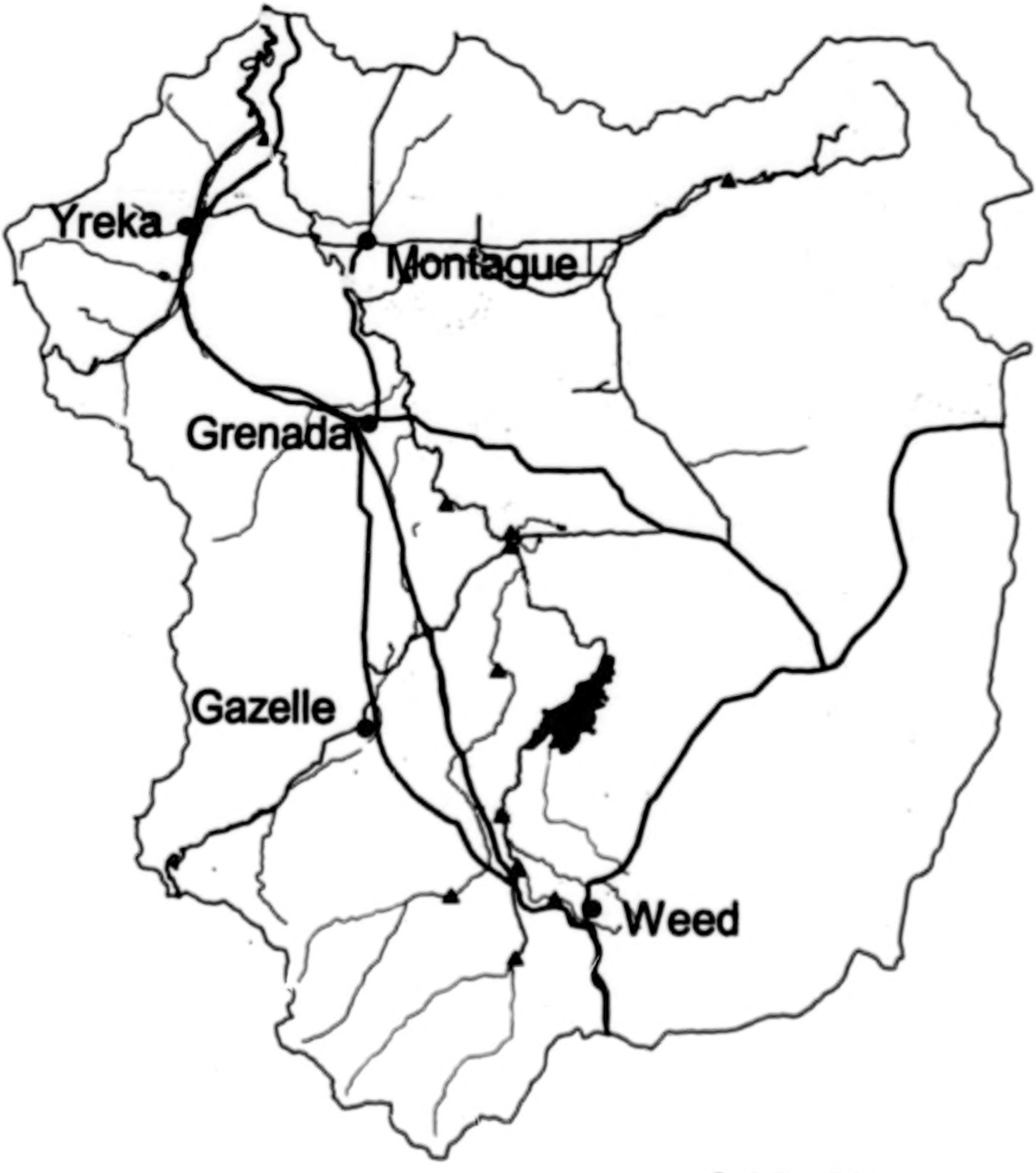
Between pressure for additional instream flows for fish, and changes in agricultural economics, the future uses of land and water in the Shasta Valley is unclear.

Attachment 1

DWR and USGS Primary Gaging Locations in the Shasta Valley

▲ DWR Gauges

USGS Gauges



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